APPENDIX B

COMPARISON WITH 1998 TOTAL SYSTEM LIFE CYCLE COST

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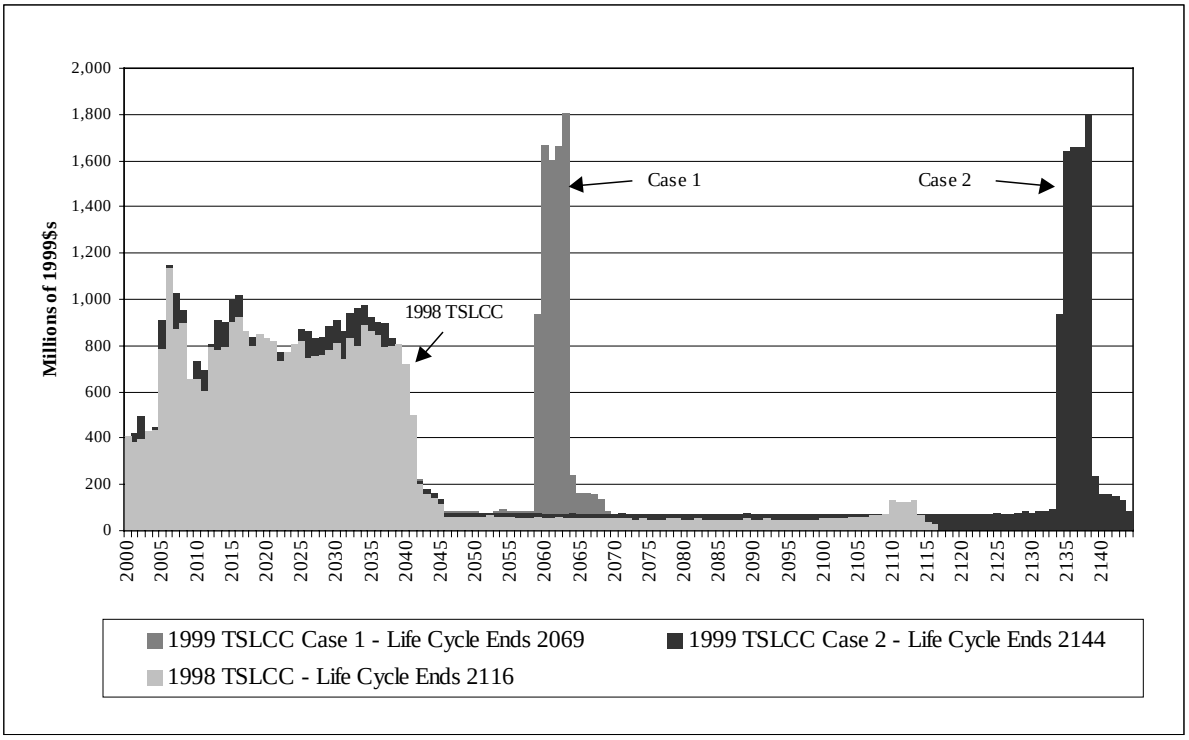
COMPARISON WITH 1998 TOTAL SYSTEM LIFE CYCLE COST

This appendix provides a comparison of the results of the current TSLCC estimate with the 1998 TSLCC estimate (DOE 1998a). The current estimate of $51.6 Billion for Case 1 and $56.9 Billion for Case 2, in constant 1999 dollars, compares with the 1998 TSLCC estimate of $44.4 Billion, escalated to 1999 dollars. The 1998 TSLCC assumed repository closure after 100 years from the start of emplacement. Cases 1 and 2 in this update cover different time periods. To facilitate a clear crosswalk between the estimates, Section B.1, Figure B-1 and Table B-1 provide a comparison of the 1998 TSLCC with a 1999 TSLCC estimate that has been adjusted to a comparable 100-year operating period. Table B-1 provides deltas between the 1998 and 1999 TSLCC estimates for impact of technical scope changes less the change in the operating period. Tables B-2 and B-3 provide a summary comparison of the results of the 1998 TSLCC estimate with the Case 1 and Case 2 TSLCC estimates, respectively, to show the combined effect of technical scope changes and the changes in the operating period. Figure B-1 shows cash a flow comparison of Case 1, Case 2 and the 1998 TSLCC.



Note: Costs for Case 1 and Case 2 are approximately equal for the fiscal years 2000 through 2050.

Figure B-1. Cash Flow Comparison of 1998 TSLCC with Case 1 and Case 2

B.1 SUMMARY COST COMPARISON WITH 1998 TSLCC

This section presents a comparison of the 1998 TSLCC (DOE 1998a) to a TSLCC estimate that includes the adoption of the EDA II design basis from the LADS Report (CRWMS M&O 1999c), and has a length similar to that of the operating period, with closure beginning 100 years after the start of emplacement. This comparison was accomplished by using the Case 2 annual data and subtracting 25 years from the monitoring phase. The changes that caused costs to increase for this analysis are the inclusion of drip shields, the lower areal mass loading that

requires excavation into the characterized lower block, backfill of the emplacement drifts, and increased pool capacity of the surface facility for blending of fuel assemblies. The changes that caused costs to decrease for this analysis are the re-evaluation of the transportation cask fleet types and cost basis.

For this analysis, with the 1999 TSLCC having a 100-year operating period, the estimate increased by $10.7 Billion in 1999 dollars, or 24.2 percent. Repository and Institutional costs increased by $11.6 Billion, which was offset by a reduction of $0.9 Billion in WAST costs. Of the $10.8 Billion increase in Repository costs, $7.5 Billion was attributable to WP and drip shield fabrication costs, $3.0 Billion for subsurface facilities, and $0.6 Billion for D&E, RIMS, and surface facility costs. The Repository cost increase was offset by a decrease of $0.3 Billion in PC costs.

Table B-1. Comparison of 1998 and 1999 TSLCC for 100 Years of Monitoring (in Millions of 1999$)

Cost Element	TSLCC 1998		TSLCC 1999	Delta	
	1998 $	1999 $	1999 $	1999 $	
Monitored Geologic Repository Costs	**29,120**	**29,600**	**40,440**	**10,840**	
Development & Evaluation (1983-2002) Costs	**5,900**	**6,020**	**6,080**	**60**	
Single Repository (MGR) (Yucca Mountain Site)	4,200	4,280	4,350	70	
Other First Repository Characterization	1,590	1,620	1,610	(10)	
Second Repository	110	120	120	0	
Surface Facilities	**6,580**	**6,680**	**7,110**	**430**	
Licensing	150	150	160	10	
Pre-Emplacement Construction	1,180	1,200	1,330	130	a
Emplacement Operations	4,320	4,390	4,640	250	a
Monitoring Operations	800	810	830	20	a
Closure & Decommissioning	130	130	160	30	a
Subsurface Facilities	**6,020**	**6,110**	**9,160**	**3,050**	
Licensing	90	94	110	16	
Pre-Emplacement Construction	980	990	1,160	170	a
Emplacement Operations	3,660	3,720	4,360	640	a
Monitoring Operations	1,080	1,100	2,290	1,190	a
Closure & Decommissioning	210	210	1,240	1,030	a
Waste Package & Drip Shield Fabrication	**5,950**	**6,040**	**13,520**	**7,480**	
Licensing	40	39	39	0	
Pre-Emplacement Construction	50	53	83	30	
Emplacement Operations	5,840	5,930	7,120	1,190	a
Monitoring Operations	20	18	800	780	a
Closure & Decommissioning	0	0	5,480	5,480	a
Performance Confirmation	**2,320**	**2,350**	**2,080**	**(270)**	
Licensing	130	130	110	(20)	
Pre-Emplacement Construction	240	240	190	(50)	a
Emplacement Operations	1,080	1,100	890	(210)	a
Monitoring Operations	870	880	860	(20)	a
Closure & Decommissioning	0	0	21	21	a
Regulatory, Infrastructure & Management Services	**2,350**	**2,400**	**2,490**	**90**	
Licensing	350	360	340	(20)	
Pre-Emplacement Construction	500	510	470	(40)	
Emplacement Operations	990	1,010	1,020	10	
Monitoring Operations	450	460	490	30	
Closure & Decommissioning	60	67	180	110	a
Waste Acceptance, Storage & Transportation	**6,390**	**6,490**	**5,630**	**(860)**	
Development & Evaluation (1983-2005) Costs	**530**	**540**	**530**	**(10)**	
Storage (no ISF Facility)	200	210	210	0	
Transportation	240	240	230	(10)	
Waste Acceptance	30	29	31	2	
MPC Project	40	38	38	0	
Project Management and Integration	20	16	16	0	
Mobilization and Acquisition (2005-2010)	**140**	**140**	**110**	**(30)**	
National Transportation	120	120	91	(29)	
Waste Acceptance	10	10	10	0	
Project Management and Integration	10	10	10	0	
Operations (2010-2042)	**5,720**	**5,810**	**4,990**	**(820)**	
National Transportation	5,660	5,750	4,930	(820)	
Waste Acceptance	60	57	57	0	
	0	0	0	0	
Nevada Transportation	**790**	**800**	**790**	**(10)**	
Engineering & Construction	700	710	710	0	
Operations	90	90	80	(10)	
Program Integration	**3,990**	**4,040**	**4,050**	**10**	
Program Management and Administration	**3,330**	**3,380**	**3,380**	**0**	
Quality Assurance	670	680	670	(10)	
Program Management and Integration	2,230	2,260	2,280	20	
Human Resources & Administration	430	440	440	0	
Non-OCRWM NWF Costs	**660**	**660**	**670**	**10**	
Nuclear Regulatory Commission	600	600	600	0	
Nuclear Waste Technical Review Board	50	51	52	1	
Nuclear Waste Negotiator	10	10	10	0	
Institutional Costs	**3,400**	**3,460**	**4,230**	**770**	
Payments Equal-To-Taxes (PETT)	2,280	2,320	2,980	660	a
Benefits	470	480	570	90	
180(c) Assistance	450	460	460	0	
Financial Assistance	200	200	210	10	
TOTAL CRWMS COST	**43,690**	**44,410**	**55,140**	**10,730**	

[a] Signifies a scope change to the category. Other deltas are due to rounding and changes in forecasted costs.

B.2 CASE 1 SUMMARY COST COMPARISON WITH 1998 TSLCC

The significant program change for Case 1 since the 1998 TSLCC (DOE 1998a) is the adoption of the EDA II design basis from the LADS Report (CRWMS M&O 1999c). The changes that caused costs to increase are the inclusion of drip shields, the lower thermal load that requires excavation into the characterized lower block, backfill of the emplacement drifts, and increased pool capacity of the surface facility for blending of fuel assemblies. The changes that caused costs to decrease for Case 1 are the reduction in the operating period from 100 years to 50 years from the start of emplacement, and the re-evaluation of the transportation cask fleet types and cost basis. For Case 1, the TSLCC estimate increased by $7.2 Billion in 1999 dollars, or 16.1 percent. Repository and institutional costs increased by $8.4 Billion, which was offset by a reduction of $1.2 Billion in WAST and Program Integration costs.

B.2.1 Monitored Geologic Repository

The cost of the repository increased by $7.9 Billion from the 1998 TSLCC (DOE 1998a) estimate for Case 1. This estimate includes increases of $7.5 Billion in WP and drip shield fabrication costs, $1.4 Billion in subsurface facility costs, $0.04 Billion in surface facility costs, and $0.06 Billion in D&E costs. There is a net decrease of $1.1 Billion in the combined repository performance confirmation and RIMS categories due to reduced workscope for performance confirmation and a decreased operating period.

Overall costs for WPs increased by $7.5 Billion primarily due to the inclusion of titanium drip shields in this cost category. Drip shield fabrication costs added $6.3 Billion to this category. Of the $6.3 Billion, $2.7 Billion was added to the end of the monitoring phase since lead-time is required to procure and fabricate the drip shields in time for their emplacement during the closure and decommissioning phase, before backfilling can begin. WP fabrication costs increased by $0.4 Billion due to an increase in the unit costs for material changes in the EDA II design. The WP fabrication costs would have been higher, but blending reduced the quantity of WPs by approximately 250 by shifting 500 small PWR WPs to large PWR WPs. The cost for WP supports increased by $0.8 Billion due to the change in material from concrete to Alloy-22 in the EDA II design.

Subsurface costs increased overall by $1.4 Billion after an increase of $2.6 Billion due to additional access excavation, ventilation, and backfill, and a reduction of $1.2 Billion for lower emplacement drift excavation and monitoring phase costs. Additional accesses to the lower block to accommodate the EDA II for a lower areal mass loading increased costs by $0.8 Billion. Ventilation at 10 cubic meters per second for the 50 years from the beginning of emplacement increased costs by approximately $1.2 Billion. Of the $1.2 Billion for ventilation, $0.1 Billion is for increased ventilation shafts, $0.7 Billion for subsurface operations that includes the added costs for vent fan purchase, replacement, and operations, and the remainder $0.4 Billion is for increased costs for support facilities and management. Backfill of the emplacement drifts with quartz sand increased the subsurface costs by $0.6 Billion. The EDA II changed the emplacement drifts loading from point-loaded to line-loaded, and changed the drift lining from concrete to steel. This reduced the drift excavation costs by $0.4 Billion. The reduction in the monitoring period by 50 years in Case 1 reduced subsurface costs by $0.8 Billion dollars.

Overall, the repository surface facility costs increased $0.04 Billion after increases for additional pool storage and operations costs, and a reduction for decreased monitoring. The surface facility costs increase $0.13 Billion for additional pool storage to accomplish the fuel blending requirements in EDA II. Surface facility operations increased by $0.25 Billion for additional activities such as fuel blending and maintenance of the solar power system. Closure and decommissioning costs increased by $0.03 Billion. These cost increases were offset by a decrease of $0.37 Billion for the reduction in the monitoring period.

Net costs for D&E increased by $0.06 Billion from the 1998 TSLCC (DOE 1998a). This increase resulted from the actual FY 1998 costs being $0.07 Billion higher than projected in the previous estimate. The decrease of $0.01 Billion in Other First Repository Costs was due to accounting adjustments in prior year costs.

The net RIMS costs decreased by $0.2 Billion from the 1998 TSLCC. The reduction in the licensing, construction, and monitoring phase reduced RIMS costs by $0.3 Billion. This decrease was offset by an increase of $0.1 Billion of cost during the emplacement, and closure and decommissioning phase to support the increased activity for installing drip shields and backfill.

The overall estimate for PC decreased by $0.9 Billion. The reduction in the monitoring phase reduced PC costs by $0.6 Billion. Costs for PC decreased an additional $0.3 Billion due to reduced work scope for the EDA II in the licensing, construction, and emplacement phases.

B.2.2 Waste Acceptance, Storage and Transportation

The change in the WAST cost estimate is a decrease of $0.9 Billion in 1999 dollars. The principal differences between the 1999 and 1998 WAST costs are the updated cask fleet and waste site modal assumptions. The following changes in cask fleet assumptions were made for 1999:

1. Use of a new transportation cask “reference” design for small single-purpose (SP) and high-heat casks. This cask has a capacity of 12 PWR or 32 BWR assemblies.

2. Use of specific dual-purpose (DP) cask designs for plants that have committed to these casks.

3. Change in the cask capacity for South Texas SNF from 12 to 17 assemblies.

4. Increase in the capacity of the large BWR SP and “generic” DP casks from 61 to 68 assemblies; decrease in the large PWR SP cask capacity from 26 to 24 assemblies (reflects a revised “reference” design for the large “generic” casks).

5. Substitution of the NAC-LWT for the NLI-1/2 as the high-heat truck cask (no change in capacity).

6. Inclusion of existing DOE-owned West Valley SNF casks.

7. Reduction in cask capacity for Big Rock Point SNF from 74 to 64 assemblies (there are 74 slots in the basket, but only 64 can carry fuel assemblies).

The following changes in waste site modal assumptions were made for the 1999 TSLCC:

1. All reactors that are projected to need (for pool overflow or to unload pool) onsite dry storage in the future (and have not already committed to a specific storage system) will utilize "generic" large rail (24 PWR/68 BWR) DP storage/transportation systems.

2. Reactors that have committed to a specific DP or SP system for storage will use that system for all onsite storage.

3. Three shutdown reactors that were previously identified as using truck casks have announced plans to offload their fuel into large DP storage systems. Therefore, these plants are assumed to transport all of their fuel in DP transportation casks.

4. Sites that utilize dry storage are assumed to transport all fuel taken from storage in DP transportation casks. Fuel taken from pools is assumed to be transported in SP casks (truck or rail).

Other changes in assumptions for the 1999 WAST calculations are as follows:

1. The commercial SNF acceptance rate in FY 2010 (400 MTHM/year) is adjusted for the actual projected start date (4/1/2010). This results in an actual commercial SNF acceptance in FY 2010 of 200 MTHM.

2. The defense waste (HLW and DOE SNF) sites (including WV) are combined into one pseudo "region" for cask fleet calculation purposes. This allows transportation resources (casks, etc.) to be shared among all the sites, which is consistent with the assumption that all HLW and DOE SNF is transported by a single RSC.

3. The start and end dates of the RSC operating "Phases" are adjusted to reflect the latest WAST Project Cost and Schedule Baseline (DOE 1999b).

4. RSC costs for supplemental community and out reach support during the first 10 years of Phase C are reduced by cutting the cost to one-half in the 6th year, and then reducing the cost linearly to zero by the 10th year.

B.2.3 Nevada Transportation

The estimate for engineering and construction of a branch rail line in Nevada has not changed in constant 1999 dollars from the 1998 TSLCC (DOE 1998a) estimate. The operations estimate was decreased slightly after re-evaluating the cost basis for the estimate.

B.2.4 Program Integration

Program Integration costs decreased by $0.3 Million. Program Integration scope was not re-evaluated for this estimate, and the decrease is due to the reduction in the monitoring phase for Case 1.

B.2.5 Institutional Costs

PETT costs have increased by $0.46 Billion in constant 1999 dollars for the 1999 TSLCC. This increase reflects the net effect of two changes in PETT costs from the 1998 TSLCC (DOE 1998a). A reduction of $0.2 Billion of PETT costs was attributable to the reduced monitoring phase. However, PETT costs increased by $0.66 Billion due to an increase in sales and use tax payment for increased capital expenditures. Capital expenditures primarily increased from the inclusion of titanium drip shields, and increased WP costs.

Benefit costs had a net increase of $20 Million due to the change in forecasted escalation rates. The forecasted escalation rates for the 1999 TSLCC decreased by approximately 0.5 percent, lowering the discount factor that is applied to future Benefit payments for conversion into constant 1999 dollars. A reduction of $50 Million of Benefit payments was saved due to the reduced monitoring phase.

The estimated cost for 180(c) Assistance has not changed in constant 1999 dollars from the previous TSLCC estimate. The $0.01 Billion increase in the life cycle cost for Financial Assistance can be attributed to a small change in cost that pushed the total across the $10 Million rounding threshold.

B.2.6 Change to Monitoring Phase

The 1998 TSLCC assumed that closure and decommissioning activities would begin in 2110, 100 years after the beginning of emplacement. The current TSLCC estimate for Case 1 assumes a reduced monitoring phase with closure and decommissioning beginning in 2060, 50 years after the beginning of emplacement. The current TSLCC assumes closure and decommissioning activities take three years more than in the previous estimate to allow for drip shield emplacement and backfill. The reduction of 50 years in the monitoring phase reduced the repository costs by $2.6 Billion in constant 1999 dollars. These cost reductions are distributed over most elements of cost, with the exception of transportation-related costs.

B.2.7 Change in Cost Share Allocation

Changes in program scope and in the TSLCC estimate resulted in changes to the civilian and DOE cost shares for Case 1. The civilian share allocation decreased from 74.9 percent to 71.8 percent, and the share for DOE SNF and HLW increased from 24.7 percent to 28.2 percent of total costs. The changes in cost shares result primarily from the decrease in the total quantity of commercial waste packages to be emplaced, due to blending commercial SNF into larger disposal containers, and the change from point-loading the emplacement drifts to line-loading. These two system changes lead to a modification of the piece-count and areal dispersion factors used for calculating the assignable common variable costs. The civilian cost share would have decreased additionally by 0.3 percent, but the WV cost share was combined with the civilian share.

Table B-2. Comparison of 1998 and 1999 TSLCC for Case 1 (in Millions of 1999$)

Cost Element	TSLCC 1998		TSLCC 1999	Delta	
	1998 $	1999 $	1999 $	1999 $	
Monitored Geologic Repository Costs	**29,120**	**29,600**	**37,470**	**7,870**	
Development & Evaluation (1983-2002) Costs	**5,900**	**6,020**	**6,080**	**60**	
Single Repository (MGR) (Yucca Mountain Site)	4,200	4,280	4,350	70	
Other First Repository Characterization	1,590	1,620	1,610	(10)	
Second Repository	110	120	120	0	
Surface Facilities	**6,580**	**6,680**	**6,720**	**40**	
Licensing	150	150	160	10	
Pre-Emplacement Construction	1,180	1,200	1,320	120	[a]
Emplacement Operations	4,320	4,390	4,640	250	[a]
Monitoring Operations	800	810	440	(370)	
Closure & Decommissioning	130	130	160	30	[a]
Subsurface Facilities	**6,020**	**6,110**	**7,510**	**1,400**	
Licensing	90	94	110	16	
Pre-Emplacement Construction	980	990	1,160	170	[a]
Emplacement Operations	3,660	3,720	4,360	640	[a]
Monitoring Operations	1,080	1,100	640	(460)	[a]
Closure & Decommissioning	210	210	1,240	1,030	[a]
Waste Package & Drip Shield Fabrication	**5,950**	**6,040**	**13,510**	**7,470**	
Licensing	40	39	39	0	
Pre-Emplacement Construction	50	53	83	30	
Emplacement Operations	5,840	5,930	7,120	1,190	[a]
Monitoring Operations	20	18	790	770	[a]
Closure & Decommissioning	0	0	5,480	5,480	[a]
Performance Confirmation	**2,320**	**2,350**	**1,450**	**(900)**	
Licensing	130	130	110	(20)	
Pre-Emplacement Construction	240	240	190	(50)	[a]
Emplacement Operations	1,080	1,100	890	(210)	[a]
Monitoring Operations	870	880	260	(620)	
Closure & Decommissioning	0	0	6	6	[a]
Regulatory, Infrastructure & Management Services	**2,350**	**2,400**	**2,200**	**(200)**	
Licensing	350	360	340	(20)	
Pre-Emplacement Construction	500	510	470	(40)	
Emplacement Operations	990	1,010	1,020	10	
Monitoring Operations	450	460	190	(270)	
Closure & Decommissioning	60	67	180	110	[a]
Waste Acceptance, Storage & Transportation	**6,390**	**6,490**	**5,630**	**(860)**	
Development & Evaluation (1983-2005) Costs	**530**	**540**	**530**	**(10)**	
Storage (no ISF Facility)	200	210	210	0	
Transportation	240	240	230	(10)	
Waste Acceptance	30	29	31	2	
MPC Project	40	38	38	0	
Project Management and Integration	20	16	16	0	
Mobilization and Acquisition (2005-2010)	**140**	**140**	**110**	**(30)**	
National Transportation	120	120	91	(29)	
Waste Acceptance	10	10	10	0	
Project Management and Integration	10	10	10	0	
Operations (2010-2042)	**5,720**	**5,810**	**4,990**	**(820)**	
National Transportation	5,660	5,750	4,930	(820)	
Waste Acceptance	60	57	57	0	
Nevada Transportation	**790**	**800**	**790**	**(10)**	
Engineering & Construction	700	710	710	0	
Operations	90	90	80	(10)	
Program Integration	**3,990**	**4,040**	**3,720**	**(320)**	
Program Management and Administration	**3,330**	**3,380**	**3,100**	**(280)**	
Quality Assurance	670	680	670	(10)	
Program Management and Integration	2,230	2,260	2,060	(200)	
Human Resources & Administration	430	440	380	(60)	
Non-OCRWM NWF Costs	**660**	**660**	**620**	**(40)**	
Nuclear Regulatory Commission	600	600	550	(50)	
Nuclear Waste Technical Review Board	50	51	52	1	
Nuclear Waste Negotiator	10	10	10	0	
Institutional Costs	**3,400**	**3,460**	**3,960**	**500**	
Payments Equal to Taxes (PETT)	2,280	2,320	2,780	460	[a]
Benefits	470	480	500	20	
180 (c) Assistance	450	460	460	0	
Financial Assistance	200	200	210	10	
TOTAL CRWMS COST	**43,690**	**44,410**	**51,570**	**7,160**	

[a] Signifies a scope change to the category. Other deltas are due to the changes in the monitoring length, forecasts, and rounding.

B.3 CASE 2 SUMMARY COST COMPARISON WITH 1998 TSLCC

The significant program change for Case 2 since the 1998 TSLCC (DOE 1998a)is the adoption of the EDA II design basis from the LADS Report (CRWMS M&O 1999c). The changes that caused costs to increase are the inclusion of drip shields, the lower thermal load that requires excavation into the characterized lower block, backfill of the emplacement drifts, the increased pool capacity of the surface facility for blending of fuel assemblies, and the increase of 25 years in the monitoring phase. The change that caused costs to decrease for Case 2 is the reevaluation of the transportation cask fleet types and cost basis. For Case 2, the TSLCC estimate increased by $12.5 Billion in 1999 dollars, or 28.1 percent. Repository and PI&I costs increased by $13.4 Billion, which was offset by a reduction of $0.9 Billion in WAST costs.

B.3.1 Monitored Geologic Repository

The cost of the repository increased by $12.3 Billion from the 1998 TSLCC (DOE 1998a) estimate for Case 2. This estimate includes increases of $7.5 Billion in WP and drip shield fabrication costs, $3.9 Billion in subsurface facility costs, $0.6 Billion in surface facility costs, $0.2 Billion in RIMS costs, and $0.1 Billion in D&E costs.

Overall costs for WPs increased by $7.5 Billion primarily due to the inclusion of titanium drip shields in this cost category. Drip shield fabrication costs added $6.3 Billion to this category. Of the $6.3 Billion, $2.7 Billion was added to the end of the monitoring phase since lead time is required to procure and fabricate the drip shields in time for their emplacement during the closure and decommissioning phase, before backfilling can begin. WP fabrication costs increased by $0.4 Billion due to an increase in the unit costs for material changes in the EDA II design. The WP fabrication costs would have been higher, but blending reduced the quantity of WPs by approximately 250 by shifting 500 small PWRs to large PWRs. The cost for WP supports increased by $0.8 Billion due to the change in material from concrete to Alloy-22 in the EDA II design.

Subsurface costs increased by $3.9 Billion due to additional access excavation to the lower block, an increased ventilation rate, backfill, and an additional 25 years of monitoring. Additional accesses to the lower block to accommodate the EDA II for a lower areal mass loading increased costs by $0.8 Billion. Ventilation at 10 cubic meters per second for the 125 years from the beginning of emplacement increased costs by approximately $2.9 Billion. Of the $2.9 Billion for ventilation, $0.1 Billion is for increased ventilation shafts, $2.1 Billion for subsurface operations (which includes the added costs for vent fan purchase, replacement, and operations), and the remainder of $0.7 Billion is for increased costs for support facilities and management. Backfill of the emplacement drifts with quartz sand increased the subsurface costs by $0.6 Billion. The EDA II changed the loading of the emplacement drifts from point-load to line-load, and changed the drift lining from concrete to steel. This reduced drift excavation costs by $0.4 Billion.

Overall, the repository surface facility costs increased $0.6 Billion after increases for additional pool storage and operations costs, and for increased monitoring. The surface facility costs increases $0.14 Billion for additional pool storage to accomplish the fuel blending requirements in EDA II. Surface facility operations increased by $0.25 Billion for additional activities such as fuel blending and maintenance of the solar power system. The monitoring phase increase added

$0.2 Billion to the surface facility cost. Closure and decommissioning costs increased by $0.03 Billion.

Costs for D&E increased by $0.06 Billion from the 1998 TSLCC (DOE 1998a). This increase resulted from the actual FY 1998 costs being $70 Million higher than projected in the previous estimate. The decrease of $0.01 Billion in Other First Repository Costs was due to accounting adjustments in prior year costs.

The RIMS costs increased by $0.24 Billion from the 1998 TSLCC. A net decrease of $0.05 for the licensing, construction, and emplacement operations phases was offset with an increase in the monitoring phase of $0.18 Billion to RIMS costs. An increase of $0.11 Billion of costs during the closure and decommissioning phase was added to support the increased activity for installing drip shields and backfill.

The estimate for PC essentially remained the same. The increase in the monitoring phase increased PC costs by $0.3 Billion. This cost increase for PC was offset by a decreased of $0.3 Billion due to reduced work scope needed for the EDA II design.

B.3.2 Waste Acceptance, Storage and Transportation

The change in the WAST cost estimate is a decrease of $0.9 Billion in 1999 dollars. The principal differences between the 1999 and 1998 WAST costs are the updated cask fleet and waste site modal assumptions. For more details see Section B.2.2.

B.3.3 Nevada Transportation

The estimate for engineering and construction of a branch rail line in Nevada has not changed in constant 1999 dollars from the 1998 TSLCC estimate (DOE 1998a). The operations estimate was decreased slightly after re-evaluating the cost basis for the estimate.

B.3.4 Program Integration

Program Integration costs increased by $0.16 Million. Program Integration scope was not re-evaluated for this estimate, and the increase is due to the extra 25 years in the monitoring phase.

B.3.5 Institutional Costs

PETT costs have increased by $0.8 Billion in constant 1999 dollars for the 1999 TSLCC. This increase reflects the effect of two changes in PETT costs from the 1998 TSLCC (DOE 1998a). An increase of $0.1 Billion of PETT costs was attributable to the increased monitoring phase. PETT costs increased by $0.7 Billion due to an increase in sales and use tax payment for increased capital expenditures for drip shields and WP costs.

Benefit costs increased by $0.1 Billion due to the increased monitoring phase and the change in forecasted escalation rates. The forecasted escalation rates for the 1999 TSLCC decreased by approximately 0.5 percent, lowering the discount factor that is applied to future Benefit payments for conversion into constant 1999 dollars.

The estimated cost for 180(c) Assistance has not changed in constant 1999 dollars from the 1998 TSLCC estimate. The $0.01 Billion increase in the life cycle cost for Financial Assistance can be attributed to a small change in cost that pushed the total across the $10 Million rounding threshold.

B.3.6 Change to Monitoring Phase

The 1998 TSLCC assumed that closure and decommissioning activities would begin in 2110, 100 years after the beginning of emplacement. The current TSLCC estimate for Case 2 assumes an increased monitoring phase with closure and decommissioning beginning in 2135, 125 years after the beginning of emplacement. The current TSLCC assumes closure and decommissioning activities take three years more than in the previous estimate for drip shield emplacement and backfill. The increase of 25 years in the monitoring phase added $1.9 Billion in constant 1999 dollars to the repository costs. This additional cost is distributed over most elements of cost, with the exception of transportation-related costs.

B.3.7 Change in Cost Share Allocation

Changes in program scope and in the TSLCC estimate resulted in changes to the civilian, WV, and DOE cost shares for Case 2. The civilian share allocation decreased from 74.9 percent to 71.3 percent and the share for DOE SNF and HLW increased from 24.7 percent to 28.7 percent of total costs. The changes in cost shares result primarily from the decrease in the total quantity of commercial waste packages to be emplaced, due to blending commercial spent fuel into larger disposal containers, and the change from point-loading the emplacement drifts to line-loading. These two system changes lead to a modification of the piece count and areal dispersion factors used for calculating the assignable common variable costs. The civilian cost share would have decreased additionally by 0.3 percent, but the WV cost share was combined with the civilian share.

Table B-3. Comparison of 1998 and 1999 TSLCC for Case 2 (in Millions of 1999$)

Cost Element	TSLCC 1998		TSLCC 1999	Delta	
	1998 $	1999 $	1999 $	1999 $	
Monitored Geologic Repository Costs	**29,120**	**29,600**	**41,930**	**12,330**	
Development & Evaluation (1983-2002) Costs	**5,900**	**6,020**	**6,080**	**60**	
Single Repository (MGR) (Yucca Mountain Site)	4,200	4,280	4,350	70	
Other First Repository Characterization	1,590	1,620	1,610	(10)	
Second Repository	110	120	120	0	
Surface Facilities	**6,580**	**6,680**	**7,300**	**620**	
Licensing	150	150	160	10	
Pre-Emplacement Construction	1,180	1,200	1,320	120	[a]
Emplacement Operations	4,320	4,390	4,640	250	[a]
Monitoring Operations	800	810	1,020	210	
Closure & Decommissioning	130	130	160	30	[a]
Subsurface Facilities	**6,020**	**6,110**	**10,000**	**3,890**	
Licensing	90	94	110	16	
Pre-Emplacement Construction	980	990	1,160	170	[a]
Emplacement Operations	3,660	3,720	4,360	640	[a]
Monitoring Operations	1,080	1,100	3,130	2,030	[a]
Closure & Decommissioning	210	210	1,240	1,030	[a]
Waste Package & Drip Shield Fabrication	**5,950**	**6,040**	**13,530**	**7,490**	
Licensing	40	39	39	0	
Pre-Emplacement Construction	50	53	83	30	
Emplacement Operations	5,840	5,930	7,120	1,190	[a]
Monitoring Operations	20	18	810	790	[a]
Closure & Decommissioning	0	0	5,480	5,480	[a]
Performance Confirmation	**2,320**	**2,350**	**2,370**	**20**	
Licensing	130	130	110	(20)	
Pre-Emplacement Construction	240	240	190	(50)	[a]
Emplacement Operations	1,080	1,100	890	(210)	[a]
Monitoring Operations	870	880	1,150	270	
Closure & Decommissioning	0	0	21	21	[a]
Regulatory, Infrastructure & Management Services	**2,350**	**2,400**	**2,650**	**240**	
Licensing	350	360	340	(20)	
Pre-Emplacement Construction	500	510	470	(40)	
Emplacement Operations	990	1,010	1,020	10	
Monitoring Operations	450	460	640	180	
Closure & Decommissioning	60	67	180	110	[a]
Waste Acceptance, Storage & Transportation	**6,390**	**6,490**	**5,630**	**(860)**	
Development & Evaluation (1983-2005) Costs	**530**	**540**	**530**	**(10)**	
Storage (no ISF Facility)	200	210	210	0	
Transportation	240	240	230	(10)	
Waste Acceptance	30	29	31	2	
MPC Project	40	38	38	0	
Project Management and Integration	20	16	16	0	
Mobilization and Acquisition (2005-2010)	**140**	**140**	**110**	**(30)**	
National Transportation	120	120	91	(29)	
Waste Acceptance	10	10	10	0	
Project Management and Integration	10	10	10	0	
Operations (2010-2042)	**5,720**	**5,810**	**4,990**	**(820)**	
National Transportation	5,660	5,750	4,930	(820)	
Waste Acceptance	60	57	57	0	
	0	0	0	0	
Nevada Transportation	**790**	**800**	**790**	**(10)**	
Engineering & Construction	700	710	710	0	
Operations	90	90	80	(10)	
Program Integration	**3,990**	**4,040**	**4,200**	**160**	
Program Management and Administration	**3,330**	**3,380**	**3,500**	**120**	
Quality Assurance	670	680	670	(10)	
Program Management and Integration	2,230	2,260	2,380	120	
Human Resources & Administration	430	440	450	10	
Non-OCRWM NWF Costs	**660**	**660**	**700**	**40**	
Nuclear Regulatory Commission	600	600	630	30	
Nuclear Waste Technical Review Board	50	51	52	1	
Nuclear Waste Negotiator	10	10	10	0	
Institutional Costs	**3,400**	**3,460**	**4,340**	**880**	
Payments Equal-To-Taxes (PETT)	2,280	2,320	3,070	750	[a]
Benefits	470	480	590	110	
180 (c) Assistance	450	460	460	0	
Financial Assistance	200	200	210	10	
TOTAL CRWMS COST	**43,690**	**44,410**	**56,890**	**12,480**	

[a] Signifies a scope change to the category. Other deltas are due to the changes in the monitoring length, forecasts, and rounding.

B.4 ASSUMPTION DIFFERENCES

The 1999 TSLCC estimate is based on assumptions that differ from those utilized in the 1998 TSLCC (DOE 1998a). Table B-4 provides a summary of differences in assumptions between the 1998 TSLCC estimate and the 1999 TSLCC estimate.

Table B-4. Differences Between the 1998 and 1999 TSLCC Assumptions

TOPIC	1998 TSLCC	1999 TSLCC
SNF Waste Stream		
SNF Discharge Projection	1995 RW-859 Data	1995 RW-859 Data
MGR Receipt Rate	See Table 3, Table 4, Table 5 in 1998 TSLCC Document	See Table 11, Table 12, Table 13 (Same as 1998 TSLCC)
Waste Acceptance		
Total Amount Accepted	86,300 MTHM Commercial SNF 19,657 defense HLW canisters (5,390 SRS; 1,190 INEEL; 12,442 Hanford, WA; 635 Pu HLW SRS) 276 canisters West Valley HLW 71 Argonne National Laboratory (ANL) HLW 2570 MTHM DOE SNF (3,857 canisters, including 300 naval canisters)	86,300 MTHM commercial SNF 19,657 defense HLW canisters (5,390 SRS; 1,190 INEEL; 12,442 Hanford, WA; 635 Pu HLW SRS) 276 canisters WV HLW 71 Argonne National Laboratory (ANL) HLW 2570 MTHM DOE SNF (3,857 canisters, including 300 naval canisters)
Start Fuel Pickup	2010	2010
Last Fuel Pickup	2041	2041
Transportation		
Cask Capacities	Rail 26 PWR/61 BWR, 12 PWR/24 BWR DPCs 24/61, 21/44, 12/24 PWR/BWR LWT 4 PWR/9 BWR, various Special Casks HLW 5 canisters, DOE SNF (1 to 6 canisters)	Rail 24 PWR/68 BWR, 12 PWR/32 BWR DPCs 24/68, 21/44 PWR/BWR LWT 4 PWR/9 BWR, various Special Casks HLW 5 canisters, DOE SNF (1 to 6 canisters)
Transportation Modal Split	11 Reactor Pool Facilities and 2 DOE Storage Sites Ship by Commercial Truck 46 Pool Facilities Ship by SM Rail 43 Pool Facilities Ship by LG Rail	8 Reactor Pool Facilities and 2 DOE Storage Sites Ship by Commercial Truck 46 Pool Facilities Ship by SM Rail 46 Pool Facilities Ship by LG Rail
Cask Life (year) / Annual Utilization (days)	RX Rail 25 / 270 LWT 25 / 300 HLW 40 / 255 DOE SNF 25 / 270	RX Rail 25 / 270 LWT 25 / 300 HLW 40 / 255 DOE SNF 25 / 270
Rail Shipping	General freight for all rail shipments	General freight for all rail shipments

Table B-4. Differences Between the 1998 and 1999 TSLCC Assumptions (Continued)

TOPIC	1998 TSLCC	1999 TSLCC
Travel Speed	Truck 960 miles/day Rail General Freight – ~10 miles/hour	Truck 960 miles/day Rail General Freight – ~10 miles/hour
Monitored Geologic Repository		
Monitoring Phase	From end of emplacement to 100 years after the beginning of emplacement.	Case 1 - From end of emplacement to 50 years after the beginning of emplacement. Case 2 - From end of emplacement to 125 years after the beginning of emplacement.
Closure & Decommissioning Phase	7 years	10 years
Waste Package Capacity	12 PWR/24 BWR 21 PWR/44 BWR 5 HLW including IPWF 5 HLW co-disposed with 1 DOE SNF DOE SNF various	12 PWR South Texas only / 24 BWR 21 PWR/44 BWR (no assembly heat limit) 5 HLW including IPWF 5 HLW co-disposed with 1 DOE SNF DOE SNF various
Emplacement Method	Large in-drift Waste Packages – Point Loaded	Large in-drift Waste Packages – Line Loaded
Cask Maintenance Facility	Limited maintenance Integrated with Repository Facilities; Responsibility of RSCs	Limited maintenance Integrated with Repository Facilities; Responsibility of RSCs
Number of Cask Shipments	From Reactor Rail (Uncanistered fuel) 5,616 From Reactor Rail (DPC) 5,425 From Reactor Truck 3,037 HLW 4,003 DOE SNF 1,252	From Reactor Rail (Uncanistered fuel) 4,804 From Reactor Rail (DPC) 4,012 From Reactor Truck 1,022 HLW 4,003 DOE SNF 1,252
Number of Waste Packages	Large - 5,723 PWR/3,734 BWR (includes 73 MOX) Small - 854 PWR/144 BWR 2,652 HLW including IPWF 1,349 HLW codisposed with DOE SNF 1,250 DOE SNF 15,706 Total	Large – 6,038 PWR/3,752 BWR (includes 73 MOX) Small - 303 PWR / 110 BWR 2,652 HLW including IPWF 1,349 HLW codisposed with DOE SNF 1,250 DOE SNF 15,454 Total